706 STRUCTURAL STEEL

706.01 DESCRIPTION

Work consists of furnishing all labor, materials, equipment, tools, and incidentals necessary to furnish, fabricate, store, assemble, shop paint, transport, erect, and place all structural steel, exclusive of bridge deck drainage and electrical conduit, pull boxes, etc., but including roadway and sidewalk joints, anchor bolts, castings, pins, rockers, shoes, alloy steels, weld metal, rivets, bolts, washers, nuts, bearing pads and other material, and also including all necessary galvanizing and the furnishing of notices, certificates, orders, statements, drawings and diagrams herein required.

Metal fabricators shall be certified in accordance with the AISC Quality Certification Program in Category I, II, or III, as appropriate. A copy of a valid certificate, along with the current annual endorsement, shall be submitted to the Engineer before any metal fabricator will be approved to perform the work.

Anchor bolts shall be furnished as part of Structural Steel and set as part of the applicable PCC items.

Before submitting a proposal, the Contractor shall become familiar with all the local conditions affecting the erection work, confer with railroad officials for work within railroad rights-of-way, or other interested parties, as the case may be, and determine the method to be followed.

A copy of the current edition of the American Welding Society "Structural Welding Code Steel" (AASHTO/AWS D1.5-88), a copy of the current edition of AASHTO "Standard Specifications for Welding of Structural Steel Highway Bridges," and a copy of the current edition of the American Institute of Steel Construction, Inc. "Manual of Steel Construction" shall be provided to the Engineer, by the Contractor, prior to the start of any steel work.

706.02 MATERIALS

The materials shall be those which are specified on the plans and shall conform to the requirements of 815.01 and 821.02, and as specified herein.

Requirements of AASHTO M 160 shall be met at all times.

Each piece of steel to be fabricated shall be properly identified.

Individual pieces furnished in tagged lifts or bundles shall be marked with the AASHTO M 160 color code immediately upon being removed from the bundle or lift.

Pieces which prior to assembly will be subject to fabricating operations such as blast cleaning, galvanizing, heating for forming, or painting which might obliterate color code marking, shall be marked for grade by steel die stamping or by a substantial tag firmly attached. All die stamps used shall be of the low stress type. If during fabrication the original identifying number is hidden, cut off, or otherwise obliterated, the fabricator may, with the Engineer's approval, repaint the number on the material at a conspicuous location.

The Contractor may furnish, from stock, material that he can identify by heat number and mill test report. Any excess material placed in stock for later use shall be marked with the mill test report number. Individually marked pieces of steel used in furnished size, or reduced from furnished size only by end or edge trim that does

not disturb the heat number or color code or leave any usable piece may be used without further color coding provided the heat number or color code remains legible. Pieces to be cut to smaller size pieces shall be legibly marked with the AASHTO M 160 color code before cutting.

Failure to meet the requirements under this section will be cause for the rejection of the material.

Threads for all bolts and pins for structural steel construction shall conform to United Standard Series UNC-ANSI B1.1, Class 2A for external threads and Class 2B for internal threads, except that the pin ends having a diameter of 1-3/8 inch or more shall be threaded 6 threads to the inch.

Galvanizing, when specified, shall meet the requirements of 811.07.

706.03 WORKMANSHIP

Workmanship and finish shall be equal to the best general practice in modern bridge shops. All portions of the work shall be neatly finished. Shearing, flame cutting, and chipping shall be done neatly and accurately. Ends of all structural members shall be chipped after cutting to remove burrs.

Pockets or depressions which would hold water shall have efficient drain holes, or be filled with red lead paste and linseed oil or as directed.

706.04 SHOP DRAWINGS

The Contractor shall prepare all shop drawings, erection diagrams, camber diagrams, and lists of bolts from general drawings of the structural steel as shown on the plans. All drawings shall be submitted in accordance with the requirements of 105.02. Unless otherwise specified herein, all detailing shall be in accordance with the requirements of the current AASHTO Standard Specifications for Highway Bridges. The Contractor shall compare and verify all dimensions shown before proceeding with the work. If any discrepancies or omissions are noticed, the Engineer shall be immediately notified and a correction obtained. All layout measurements shall conform to the plans.

Shop drawings shall specifically identify each piece to be made of steel other than AASHTO M 183. Pieces made of different grades of steel shall not be given the same assembling or erecting mark, even though they are of identical dimensions and detail. The Contractor's system of assembly-marking individual pieces and the issuance of cutting instructions to the shop shall be such as to maintain identity of the mill test report number.

706.05 INSPECTION

(A) GENERAL. The Inspector shall have full access at all times to all parts of mills or shops where material to be inspected is being manufactured or fabricated.

The Inspector shall have the authority to reject any or all material or work which does not meet the requirements of the specifications. In case of dispute, the Contractor may appeal to the Engineer, whose decision will be final.

The acceptance of any material or finished members by the Inspector will not bar their subsequent rejection, if found defective. Rejected material and workmanship shall be replaced and/or repaired to the

satisfaction of the Engineer.

(B) MILL INSPECTION. The Contractor shall furnish the Engineer, in duplicate, certified mill test reports and written certification that the material of each heat of steel meets the requirements.

Only material properly checked, sorted, and stored shall be used.

(C) SHOP INSPECTION. Shop inspection will be performed by the District or an authorized agency of the District. The Engineer shall be notified well in advance of the start of the work in the shop in order that arrangements may be made for shop inspection of material and workmanship. The fabricator shall furnish necessary facilities for inspection of workmanship and physical tests. The District must approve shop facilities to be used for fabrication prior to start of the fabrication process.

Only one reinspection for each instance of corrective action will be allowed at no cost to the Contractor. All costs associated with further reinspections will be charged to the Contractor.

(D) NOTCH TOUGHNESS REQUIREMENTS. Structural steel within the tension zone for members such as stringers, girder webs and flanges, including cross girder and bracket webs and flanges, girder splice plates and box column plates, conforming to AASHTO M270 Grade 50 and AASHTO M270 Grade 36, shall meet the longitudinal Charpy V-notch test specified in Table A below. Sampling and testing shall be in accordance with AASHTO T243(ASTM A 673-72). The (H) frequency of heat transfer shall be used.

TABLE A

AASHTO Designation	Thickness In Inches	CVN In Foot Pounds
M 270 Grade 36	ALL	15 @ 40 degrees F
M 270 Grade 50	Up to 4" mechanically fastened	15 @ 40 degrees F
	Up to 2" welded	15 @ 40 degrees F
	Over 2" welded	20 @ 40 degrees F

706.06 SHOP STORAGE OF MATERIAL

Structural material, either plain or fabricated, shall be stored at the bridge shop above the ground upon platforms, skids, or other supports. It shall be kept free from dirt, grease, and other foreign matter, and shall be protected as far as practicable from corrosion.

706.07 STRAIGHTENING MATERIAL

Rolled material, before being laid off or worked, must be straight. If straightening is necessary, it shall be done by approved methods that will not injure the metal. Sharp kinks and bends shall be cause for rejection of the material.

Straightening main stress carrying members may only be done when permitted in writing by the Contracting Officer. When permitted by the Engineer, straightening of shapes, plates, and built-up members

which are not primary members, shall be done by methods that will not produce fracture or other structural defects. Distorted members shall be straightened by mechanical means or, if approved, by carefully planned and supervised application of a limited amount of localized heat. Heat shall not be applied directly on weld metal. The temperature of the heated area shall not exceed 1200°F (a dull red) nor 950°F at the weld metal and within 6 inches of weld metal, as controlled by temperature indicating crayons, liquids or bimetal thermometers. After heating, the metal shall be cooled as slowly as possible. Quenching is prohibited.

Parts to be heat straightened shall be substantially free from stress and from external forces, except stresses resulting from mechanical means used in conjunction with the application of heat.

Following the straightening of a bend or buckle, the surface of the metal will be inspected at Contractor's expense by methods as directed. Metal with evidence of fracture will be rejected.

706.08 FLAME CUTTING

Steel and weld metal shall be oxygen cut per AASHTO/AWS D1.5-88, as modified by the AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges, provided a smooth and regular surface free from cracks and notches is secured, and provided an accurate profile from cracks and notches is secured, and provided an accurate profile is secured by use of a mechanical guide. Hand cutting shall be done only where approved.

Mill scale and extraneous material shall be removed from the torch side of ASTM A514/A517 steel plates along the lines to be flame cut, when necessary to obviate excessive notches.

706.09 BENT PLATES

Unwelded, cold-bent, load-carrying, rolled-steel plates shall conform to the following:

1. They shall be so taken from the stock plates that the bend line will be at right angles to the direction of rolling, except that cold-bent ribs for orthotropic deck bridges may be bent in the direction of rolling if permitted by the Engineer.

2. Bending shall be such that no cracking of the plate occurs. Minimum bend radii, measured to the concave face of the metal, are shown in the following table:

THICKNESS IN INCHES

	Up to 1/2	>1/2 to 1	>1 to 1-1/2	>1-1/2 to 2-1/2	>2-1/2 to 4
All grades of structural steel in this specification	2 t	2.5 t	3 t	3.5 t	4 t

Note: Low alloy steel in thicknesses over 1/2" may require hot bending for small radii.

Allowance for springback of A514 and A517 steels should be about 3 times that for structural carbon steel. For brake press forming, the lower die span should be at least 16 times the plate thickness. Multiple hits are advisable.

If a shorter radius is essential, the plates shall be bent hot at a temperature not greater than 1200°F, except for A514/A517 steel. If A514/A517 steel plates to be bent are heated to a temperature greater than 1125°F, they must be requenched and tempered in accordance with the producing mill's practice. Hot bent plates shall conform to requirement 1, above.

3. Before bending, the corners of the plate shall be rounded to a radius of 1/16 inch throughout the portion of the plate at which the bending is to occur.

706.10 ANNEALING AND STRESS RELIEVING

Structural members to be annealed or normalized shall have finished machining, boring, and straightening done subsequent to heat treatment. Normalizing and full annealing shall be per AASHTO/AWS D1.5. The temperatures shall be maintained uniformly throughout the furnace during the heating and cooling so that the temperature at no two points on the member will differ by more than 100°F at any one time.

Members of A514/A517 steels shall not be annealed or normalized and shall be stress relieved only with the approval of the Engineer.

Pieces in each furnace charge, temperatures and schedule used shall be recorded. Proper instruments including recording pyrometers shall be used to determine at any time the temperatures of members in the furnace. Treatment records shall be submitted on request. The holding temperature for stress relieving A514/A517 steel shall not exceed 1125°F.

Members, such as bridge shoes, pedestals and other parts which are built up by welding sections of plate together shall be stress relieved per AASHTO/AWS.

706.11 HOLES FOR BOLTS

This specification applies to bolt holes for bolted connections specified in 706.16 and 706.17.

All holes for bolts shall be either punched or drilled. Flame cutting is prohibited. Material forming parts of a member composed of not more than 5 thicknesses of metal may be punched 1/16 inch larger than the nominal diameter of the bolts whenever the thickness of the material is not greater than 3/4 inch for structural steel, 5/8 inch for high-alloy steel, or 1/2 inch for quenched and tempered alloy steel, unless subpunching and reaming are required.

When there are more than 5 thicknesses or when any of the main material is thicker than 3/4 inch for structural steel, 5/8 inch for high strength steel, or 1/2 inch for quenched and tempered alloy steel, all holes shall either be subdrilled or drilled full size.

All holes for ribbed bolts and other approved bearing-type bolts shall be subpunched or subdrilled 3/16 inch smaller than bolt nominal diameter and reamed assembled or to a steel template or, after assembly, drilled from the solid. In any case the finished holes shall provide a driving fit as specified.

Die diameter shall not exceed the diameter of the punch by more than 1/16 inch. If any holes must be enlarged to admit bolts such holes shall be reamed. Holes shall be clean cut without torn or ragged edges. Poor matching of holes will be cause for rejection.

Reamed and drilled holes shall be cylindrical and perpendicular to the member. Where practicable, reamers shall be directed by mechanical means. Burrs on outside surfaces shall be removed. Poor matching of

holes will be cause for rejection. Reaming and drilling shall be done with twist drills. Assembled parts shall be taken apart for removal of burrs and shavings caused by drilling and reaming. Connecting parts requiring reamed or drilled holes shall be assembled and securely held while being reamed or drilled and shall be match marked before disassembly.

Holes in all field connections and field splices shall be subpunched or subdrilled (subdrilling if thickness limitations govern) 3/16 inch smaller as required and then reamed 1/16 inch larger while assembled or reamed to a steel template. All holes for floor beam and stringer field end connection holes through a steel template shall be done after the template has been located as to position and angle and firmly bolted in place. Templates used for reaming matching members, or the opposite faces of a single member, shall be exact duplicates.

Templates used for connections on like parts or members shall be so accurately located that the parts or members are duplicates and require no match marking.

All holes punched full size, subpunched or subdrilled shall be accurately punched so that after assembly and before reaming, a cylindrical pin 1/8 inch smaller in diameter than the punched hole nominal size may be entered perpendicular to the face of the member, without drifting, in at least 75 percent of the contiguous holes in the same plane. Members with holes failing to meet this requirement will be rejected. Members shall be rejected with a hole through which a pin, 3/16 inch smaller in diameter than punched hole nominal size will not pass.

When holes are reamed or drilled, 85 percent of the holes in any contiguous group shall, after reaming or drilling, show no offset greater than 1/32 inch between adjacent thicknesses of metal.

All steel templates shall have hardened steel bushings in holes accurately dimensioned from the center lines of the connection as inscribed on the templates. The center lines shall be used in locating accurately the template from the milled or scribed ends of the members.

706.12 FINISHING AND FITTING

(A) GENERAL. Finished members shall be true to line and free from twists, bends and open joints.

(B) EDGE PLANING. Sheared edges of plates more than 5/8 inch thickness and carrying calculated stress shall be planed to a depth of 1/4 inch. Re-entrant corners shall be filleted to a radius of 3/4 inch before cutting.

(C) FACING OF BEARING SURFACES. The surface finish of bearing and base plates and other bearing surfaces that are to come in contact with each other or with PCC shall meet the ANSI surface roughness requirements as defined in ANSI B46.1, Surface Roughness, Waviness and Lay, Part I:

Bearing Surfaces	ANSI Finish
Heavy plates in contact in shoes to be welded	1,000
Milled ends of compression members, stiffeners and fillers	500
Bridge rollers and rockers	250
Pins and pin holes	125
Sliding bearings	125

(D) ABUTTING JOINTS. Abutting joints in compression members and girder flanges, and in tension

members where so specified on the drawings, shall be faced and brought to an even bearing. Where joints are not faced, the opening shall not exceed 1/4 inch.

(E) FABRICATION OF MEMBERS. Unless otherwise shown on the plans, steel plates for main members, not secondary members, shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stresses.

(F) END CONNECTION ANGLES. Floorbeams, stringers, and girders having end connection angles shall be built to exact length shown on the plans measured between heels of the connection angles, with a permissible tolerance of plus 0 inch to minus 1/16 inch. Where continuity is to be required, end connections shall be faced. The thickness of the connection angles shall not be less than 3/8 inch nor less than that shown on the detail drawings, after facing.

(G) LACING BARS. The end of lacing bars shall be neatly rounded unless another form is specified.

(H) WEB PLATES. At web splices, the clearance between the ends of the web plates shall not exceed 3/8 inch. The clearances at the top and bottom ends of the web slice plates shall not exceed 1/4 inch.

(I) FIT OF STIFFENERS. Unless otherwise shown on the plans, end stiffeners of girders and stiffeners intended as supports for concentrated loads shall be milled or ground to secure an even bearing against the flanges. Intermediate stiffeners shall fit sufficiently tight to exclude water after being painted. Fillers under stiffeners shall fit within 1/4 inch at each end.

Welding will be permitted in lieu of milling or grinding if noted on the plans. Welding on the tension flanges of beams and girders will not be permitted unless shown on the plans.

706.13 CAMBER

When specified cambers for rolled beams are shown on the plans, the beams shall be cambered in the rolling mill, either while hot or else in the straightening gag after cooling. Cambers for rolled beams shall conform to standard mill practices as specified by AISC. During mill operations and fabrication of splices, beams shall be so supported that the camber is maintained.

When camber is not specified, rolled beams shall be fabricated with standard mill camber with convex flange up.

All built-up main girders and other members shall be cambered as nearly as practicable to conform to the dead load deflection shown on the plans. Camber diagrams showing the cambers required for the dead load deflections shown on the plans shall be submitted for approval.

A tolerance of 1/2 inch more, nothing less, will be allowed.

706.14 SHOP ASSEMBLING

The field connections of main members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, and rigid frames shall be assembled in the shop with milled ends of compression members in full bearing, and then shall have their sub-size holes reamed to specified size while the connections are assembled. Assembly shall be Full Truss or Girder Assembly, unless a Progressive Truss or Girder Assembly, Full Chord Assembly, Progressive Chord Assembly, or Special Complete Structure Assembly is specified in

the special provisions.

(A) FULL TRUSS OR GIRDER ASSEMBLY. Full Truss or Girder Assembly shall consist of assembling all members of each truss, arch rib, bent, tower face, continuous beam line, plate girder, or rigid frame at one time.

(B) PROGRESSIVE TRUSS OR GIRDER ASSEMBLY. Progressive Truss or Girder Assembly shall consist of assembling initially for each truss, arch rib, bent, tower face, continuous beam line, plate girder, or rigid frame at least three contiguous shop sections or all members in at least three contiguous panels but not less than the number of panels associated with three contiguous chord lengths (i.e., length between field splices) and not less than 150 feet in the case of structures longer than 150 feet. At least one shop section or panel or as many panels as are associated with a chord length shall be added at the advancing end of the assembly before any member is removed from the rearward end, so that the assembled portion of the structure is never less than that specified above.

(C) FULL CHORD ASSEMBLY. Full Chord Assembly shall consist of assembling, with geometric angles at the joints, the full length of each chord of each truss or open spandrel arch, or each leg of each bent or tower, then reaming their field connection holes while the members are assembled and reaming the web member connections to steel templates set at geometric (not cambered) angular relation to the chord lines.

Field connection holes in web members shall be reamed to steel templates. At least one end of each web member shall be milled or shall be scribed normal to the longitudinal axis of the member and the templates at both ends of the member shall be accurately located from one of the milled ends or scribed lines.

(D) PROGRESSIVE CHORD ASSEMBLY. Progressive Chord Assembly shall consist of assembling contiguous chord members in the manner specified for Full Chord Assembly and in the number and length specified for Progressive Truss or Girder Assembly.

(E) SPECIAL COMPLETE STRUCTURE ASSEMBLY. Special Complete Structure Assembly shall consist of assembling the entire structure, including the floor system. (This procedure is ordinarily needed only for complicated structures such as those having curved girders, or extreme skew in combination with severe grade or camber.)

Each assembly, including camber, alignment, accuracy of holes, and fit of milled joints, shall be approved by the Engineer before reaming is commenced.

A camber diagram shall be furnished the Engineer by the Fabricator showing the camber of each panel point of each truss, arch rib, continuous beam line, plate girder or rigid frame. When the shop assembly is Full Truss or Girder Assembly or Special Complete Structure Assembly, the camber diagram shall show the camber measured in assembly. When any of the other methods of shop assembly is used, the camber diagram shall show calculated camber.

Surfaces of metal in contact shall be cleaned before assembling. The parts of a member shall be assembled, well pinned, and firmly drawn together with bolts before reaming is commenced. Assembled pieces shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation. The member shall be free from twists, bends, and other deformations.

Preparatory to the shop bolting of full-sized punched material, the holes, if necessary, shall be spear-reamed for the admission of the bolts. The reamed holes shall not be more than 1/16 inch larger than the

nominal diameter of the bolts.

End connection angles, stiffener angles, and similar parts shall be carefully adjusted to correct positions and bolted, clamped, or otherwise firmly held in place until bolted.

Parts not completely bolted in the shop shall be secured by bolts, insofar as practicable, to prevent damage in shipment and handling.

The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit the bolts, they shall be reamed.

Connecting parts assembled in the shop for the purpose of reaming holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished to the Engineer.

706.15 PINS AND ROLLERS

Pins and rollers shall be accurately turned to the dimensions shown on the drawings and shall be straight, smooth, and free from flaws.

Pins and rollers more than 9 inches in diameter shall be forged and annealed.

Pins and rollers 9 inches or less in diameter may be either forged and annealed or cold-finish carbon-steel shafting.

In pins larger than 9 inches in diameter, a hole not less than 2 inches in diameter shall be bored full length along the axis after the forging has been allowed to cool to a temperature below the critical range, under suitable conditions to prevent injury by too rapid cooling, and before being annealed.

Pin holes shall be bored true to the specified diameter, smooth, and straight, at right angles with the axis of the member, and parallel with each other unless otherwise specified. The final surface shall be produced by a finishing cut.

The distance outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary more than 1/32 inch from that specified. Boring of holes in built-up members shall be done after assembly is completed.

The diameter of the pin hole shall not exceed that of the pin by more than 1/50 inch for pins 5 inches in diameter, or 1/32 inch for larger pins.

Two pilot nuts and two driving nuts for each size of pin shall be furnished for use in driving pins. Pins shall be so driven that the members will take full bearing on them. Pin nuts shall be drawn up right and the threads burred at the face of the nut with a pointed tool.

706.16 BOLTS AND BOLTED CONNECTIONS

The specifications of this article do not pertain to the use of high strength bolts. Connections fabricated with high strength bolts shall conform to 706.17.

Bolts shall be unfinished, turned, or ribbed bolts per ASTM A 307, Grade A. Bolted connections shall be used only as indicated. Bolts shall have single self-locking nuts or double nuts. Beveled washers shall be used where bearing faces have a slope of more than 1/20 with respect to a plane normal to bolt axis.

Unfinished bolts shall be furnished unless other types are specified.

The surface of the body of turned bolts shall meet ANSI 125 finish. Heads and nuts shall be hexagonal with standard dimensions for bolts of the nominal size specified or the next larger nominal size. Diameter of threads shall be equal to the body of the bolt or the nominal diameter of the bolt specified. Holes for turned bolts shall be carefully reamed with bolts furnished to provide a light driving fit. Threads shall be entirely outside of the holes. A washer shall be provided under the nut.

The body of ribbed bolts shall be of an approved form with continuous longitudinal ribs. The diameter of the body measured on a circle through the points of the ribs shall be 5/64 inch greater than the nominal diameter specified for the bolts. Ribbed bolts shall be furnished with round heads per ANSI B 18.5. Nuts shall be hexagonal, either recessed or with a washer of suitable thickness. Ribbed bolts shall make a driving fit with the holes. The hardness of the ribs shall be such that the ribs do not mash down enough to permit the bolts to turn in the holes during tightening. If for any reason the bolt twists before drawing tight, the hole shall be carefully reamed and an oversized bolt used as a replacement.

706.17 HIGH-STRENGTH STEEL BOLT CONNECTIONS

(A) GENERAL - This specification applies to all structural steel connections using AASHTO M164 (ASTM A325) high strength bolts.

(1) All AASHTO M164 (ASTM A325) high strength bolts, nuts and washers shall be furnished in accordance with the appropriate AASHTO materials specifications as amended and revised herein.

(2) Additional requirements for field or shop installation of AASHTO M164 (ASTM A 325) high strength bolts are also included. These additional requirements supplement AASHTO Division II, Section 11.

(B) SPECIFICATIONS - All hardware covered by this specification shall meet the following requirements:

(1) All bolts shall meet the requirements of AASHTO M164 (ASTM A 325) and these revisions.

(2) All nuts shall meet the requirements of AASHTO M292 (ASTM A194), as applicable or AASHTO M291 (ASTM A563) and these revisions.

(3) All washers shall meet the requirements of AASHTO M293 (ASTM F436) and these revisions.

(C) MANUFACTURING -

(1) Bolts:

The hardness for bolt diameters 1/2 inch to 1 inch inclusive shall be as noted below:

	Hardness Number

Bolt Size	Brinell		Rockwell C	
	Min	Max	Min	Max
1/2 to 1 inch	248	311	24	33

(2) Nuts:

(a) Nuts to be galvanized (hot dip or mechanically galvanized) shall be heat treated grade 2H, DH, or DH3.

(b) Plain (ungalvanized) nuts shall be grades 2, C, D or C3 with a minimum Rockwell hardness of 89 HRB (or Brinell hardness 180 HB), or heat treated grades 2H, DH or DH3. (The hardness requirements for grades 2, C, D and C3 exceed the current AASHTO/ASTM requirements).

(c) Nuts that are to be galvanized shall be tapped oversize the minimum amount required for proper assembly. The amount of overtap in the nut shall be such that the nut will assemble freely on the bolt in the coated condition and shall meet the mechanical requirements of AASHTO M291 (ASTM A 563) and the rotational capacity test herein (the overtapping requirements of AASHTO M291 [ASTM A 563], paragraph 7.4 shall be considered maximum values instead of minimum, as currently shown).

(d) Galvanized nuts shall be lubricated with a lubricant containing a dye of any color that contrasts with the color of the galvanizing.

(3) Marking - All bolts, nuts and washers shall be marked in accordance with the appropriate AASHTO/ASTM Specifications.

(D) TESTING

(1) Bolts:

(a) Proof load tests (ASTM F 606 Method 1) are required. The minimum frequency of tests shall be as specified in AASHTO M164 (ASTM A 325), paragraph 9.2.4.

(b) Wedge tests on full size bolts (ASTM F 606, paragraph 3.5) are required. If bolts are to be galvanized, tests shall be performed after galvanizing. The minimum frequency of tests shall be as specified in AASHTO M164 (ASTM A 325), paragraph 9.2.4.

(c) If galvanized bolts are supplied, the thickness of the zinc coating shall be measured. Measurements shall be taken on the wrench flats or top of bolt head.

(2) Nuts:

(a) Proof load tests (ASTM F 606, paragraph 4.2) are required. The minimum frequency of tests shall be as specified in AASHTO M291 (ASTM A 563), paragraph 9.3 or AASHTO M292 (ASTM A 194), paragraph 7.1.2.1. If nuts are to be galvanized, tests shall be performed after galvanizing, overtapping and lubricating.

(b) If galvanized nuts are supplied, the thickness of the zinc coating shall be measured. Measurements shall be taken on the wrench flats.

(3) Washers:

(a) If galvanized washers are supplied, hardness testing shall be performed after galvanizing. (The coating shall be removed prior to taking hardness measurements).

(b) If galvanized washers are supplied, the thickness of the zinc coating shall be measured.

(4) Assemblies:

Rotational capacity tests are required and shall be performed on all black or galvanized (after galvanizing) bolt, nut and washer assemblies by the manufacturer or distributor prior to shipping. The use of washers is required as part of the test even though they may not be required as part of the installation procedure.

The following shall apply:

(a) Except as modified herein, the rotational capacity test shall be performed in accordance with the requirements of AASHTO M164 (ASTM A 325).

(b) Each combination of bolt production lot, nut lot and washer lot shall be tested as an assembly. Where washers are not required by the installation procedures, they need not be included in the lot identification.

(c) A rotational capacity lot identification number shall be assigned to each combination of lots tested.

(d) The minimum frequency of testing shall be two assemblies per rotational capacity lot.

(e) The bolt, nut and washer assembly shall be assembled in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device (note - this requirement supersedes the current AASHTO M164 [ASTM A 325] requirement that the test be performed in a steel joint). For bolts which are too short to be assembled in the Skidmore-Wilhelm Calibrator, see Section C.4.i.

(f) The minimum rotation, from a snug tight condition (10% of the specified proof load), shall be:

240 degrees (2/3 turn) for bolt lengths less than or equal to 4 diameters
360 degrees (1 turn) for bolt lengths greater than 4 diameters to less than or equal to 8 diameters
480 degrees (1 1/3 turn) for bolt lengths greater than 8 diameters

(Note: These values differ from the AASHTO M164 Table 8/ ASTM A 325 Table 6 Specifications).

(g) The tension reached at the above rotation shall be equal to or greater than 1.15 times the required installation tension. The installation tension and the tension for the turn test are shown below:

Diameter (inches)	1	5	3	7	1	1-1/8	1-1/4	1-3/8	1-1/2
Required Installation Tension (kips)	1	1	2	3	5	56	71	85	103
Turn Test Tension (kips)	1	2	3	4	5	64	82	98	118

(h) After the required installation tension listed above has been exceeded, one reading of tension and torque shall be taken and recorded. The torque value shall conform to the following:

Torque is less than or equal to 0.25 PD where:

Torque	=	measured torque (foot-pounds)
P	=	measured bolt tension (pounds)
D	=	bolt diameter (feet)

(i) Bolts that are too short to test in a Skidmore-Wilhelm Calibrator may be tested in a steel joint. The tension requirement of Section D.4.g. shall be computed using a value of P equal to the turn test tension shown in the table in Section D.4.g.

(5) Reporting:

(a) The results of all tests (including zinc coating thickness) required herein and in the appropriate AASHTO specifications shall be recorded on the appropriate document.

(b) The location where tests are performed and the date of the tests shall be reported on the appropriate document.

(6) Witnessing:

The tests need not be witnessed by an inspection agency; however, the manufacturer or distributer that performs the tests shall certify that the results recorded are accurate.

(E) DOCUMENTATION

(1) Mill Test Report(s) (MTR):

(a) MTR shall be furnished for all mill steel used in the manufacture of the bolts, nuts and washers.

(b) MTR shall indicate the place where the material was melted and manufactured.

(2) Manufacturer Certified Test Report(s) (MCTR):

(a) The manufacturer of the bolts, nuts and washers shall furnish test reports (MCTR) for the item furnished.

(b) Each MCTR shall show the relevant information required in accordance with Section D.5.

(c) The manufacturer performing the rotational capacity test shall include in the MCTR:

(1) The lot number of each of the items tested.

(2) The rotational capacity lot number as required in Section D.4.

(3) The results of the tests required in Section D.4.

(4) The pertinent information required in D.5.a.

(5) A statement that MCTR for the items are in conformance with this specification and the appropriate AASHTO specifications.

(6) The location where the bolt assembly components were manufactured.

(3) Distributor Certified Test Report(s) (DCTR):

(a) The DCTR shall include MCTR above for the various bolt assembly components.

(b) The rotational capacity test may be performed by a distributor (in lieu of a manufacturer) and reported in the DCTR.

(c) The DCTR shall show the results of the tests required in Section D.4.

(d) The DCTR shall also show the pertinent information required in Section D.5.b.

(e) The DCTR shall show the rotational capacity lot number as required in Section D.4.c.

(f) The DCTR shall certify that the MCTR are in conformance with this specification and the appropriate AASHTO specification.

(F) SHIPPING:

(1) Bolts, nuts and washers (where required) from each rotational capacity lot shall be shipped in the same container. If there is only one production lot number for each size of nut and washer, the nuts and washers may be shipped in separate containers. Each container shall be permanently marked with the rotational capacity lot number such that identification will be possible at any stage prior to installation.

(2) The appropriate MTR, MCTR or DCTR shall be supplied to the Contractor or Owner as required by the Contract Documents.

(G) INSTALLATION:

The following requirements for installation apply in addition to the specifications in AASHTO Division

II, Section 11 when high strength bolts are installed in the field or shop.

(1) Bolts shall be installed in accordance with AASHTO Division II, Article 11.5.6. During installation, regardless of the tightening method used, particular care should be exercised so that the snug tight condition as defined in Article 11.5.6 is achieved.

(2) The rotational capacity test described in Section C.4. above shall be performed on each rotational capacity lot prior to the start of bolt installation. Hardened steel washers are required as part of the test although they may not be required in the actual installation procedures.

(3) A Skidmore-Wilhelm Calibrator or an acceptable equivalent tension measuring device shall be required at each job site during erection. Periodic testing (at least one each working day when the calibrated wrench method is used) shall be performed to assure compliance with the installation test procedures required in AASHTO Division II, Article 11.5.6.4 for Turn-of-Nut Tightening, Calibrated Wrench Tightening, Installation of Alternate Design Bolts and Direct Tension Indicator Tightening. Bolts that are too short for the Skidmore-Wilhelm Calibrator may be tested using direct tension indicators (DTIs). The DTIs must be calibrated in the Skidmore-Wilhelm Calibrator using longer bolts. The tests shall be performed by the Contractor and witnessed by the Engineer.

(4) Lubrication

(a) Galvanized nuts shall be checked to verify that a visible lubricant is on the threads.

(b) Black bolts shall be "oily" to the touch when delivered and installed.

(c) Weathered or rusted bolts or nuts not satisfying the requirements of (a) or (b) above shall be cleaned and relubricated prior to installation. Recleaned or relubricated bolt, nut and washer assemblies shall be retested in accordance with (b) above prior to installation.

(5) Bolt, nut and washer (when required) combinations as installed shall be from the same rotational capacity lot.

(H) CONDITION OF BOLTED PARTS. The slope of surfaces of bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to bolt axis. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material.

When assembled, all joint and bolt assembly surfaces shall be free of scale, except tight mill scale, and shall also be free of dirt, burrs, foreign material, and other defects that may prevent solid seating of the parts.

Contact surfaces within friction-type joints shall be free of oil, paint, lacquer, and rust inhibitor. Galvanized surfaces shall be wire-brushed or brush-off blasted.

(I) BOLT INSPECTION. The Contractor shall furnish for the Engineer's use dependable and approved hand torque wrenches and/or torque multiplier wrenches that can be accurately adjusted to specified limits, and bolt tension calibrators as required. Pneumatic wrenches are prohibited for bolt inspection and testing. Wrench calibration certification, by an approved agency equipped to perform torque wrench testing, shall accompany the wrenches and shall include identity of wrenches and date of calibration.

The Contractor shall furnish all labor, materials, equipment, and rigging and perform shop and field

bolted connection inspection in a safe and convenient manner. The inspection shall be witnessed by the Engineer.

Regardless of the method of bolt installation, bolts in each connection shall be inspected as specified under this sub- section.

To determine job inspection torque, 3 test bolts of the same grade, size and condition as those under inspection shall be placed individually in a calibration device furnished by the Contractor and capable of indicating required bolt tension. There shall be a washer under the part turned in tightening each bolt.

The job inspecting torque shall be determined by a torque wrench. Each test bolt specified shall be tightened in the calibration device by any convenient means to the minimum required tension. The torque wrench then shall be applied to the tightened bolt and the torque necessary to turn the nut or head 5 degrees (approximately 1 inch at 12 inch radius) in tightening direction shall be determined. The average torque measured in the test of 3 bolts shall be taken as the job inspecting torque to be used for bolts under inspection.

The wrench and its job inspecting torque then shall be applied to 15 percent of the bolts, but no less than 3 bolts, selected at random in each connection, whether tightened by wrench or turn of nut method. If no nut or bolt head is turned by application of the job inspecting torque, the connection shall be accepted as properly tightened. If any nut or bolt head is turned by application of the job inspecting torque, the Contractor shall have this torque applied to all bolts in the connection, and all bolts whose nut or head is turned by the job inspecting torque shall be tightened and reinspected.

When a bolt is properly tightened in place, at least 3 but not more than 5 threads shall be visible above the nut.

706.18 WELDING

(A) GENERAL. Structures shall be welded in accordance with the Plans, Special Provisions, and the current edition of AASHTO "Standard Specifications for Welding of Structural Steel Highway Bridges" and the edition of the American Welding Society "Structural Welding Code AASHTO/AWS D1.5".

(B) QUALIFICATIONS OF PROCEDURES. Prequalified welding procedures and welding procedures to be qualified shall be submitted to the Engineer for approval using the forms shown in AWS D1.1, Appendix E. No welding shall be done prior to the Engineer's approval of the welding procedures. No unspecified temporary or permanent weld shall be made without specific written approval.

(C) QUALIFICATION OF WELDERS. Properly documented evidence of successful completion of qualification tests under the supervision of an approved testing agency and as prescribed in AASHTO shall be submitted for all welders, welding operators, and tackers. Approval by the Engineer shall be obtained prior to any welding. Qualified welders shall be retested if they have not practiced welding for six months preceding the start of welding work. Evidence of such welding practice shall be satisfactory to the Engineer.

(D) WORKMANSHIP AND TECHNIQUE. Electrodes per AWS, A5.5, shall be dried 1 hour plus or minus 15 minutes before being used. If flux is used from an opened package or dispensing system inoperative for 4 hours or more, the top 1 inch shall be discarded.

The first weld pass shall be given special attention to ensure proper fusion and penetration of the base metal at root of joint.

In addition to AWS D1.5, Section 3.5, Dimensional Tolerances, the combined warpage and tilt offset of flanges of welded box girders shall not exceed 1/100 of flange width between two adjacent webs, or 1/4 inch, whichever is greater.

Additional work and revised approved design required due to correction of deficient welds shall be at the Contractor expense.

Peening, when approved, shall be done preferably while the weld is hot and with a hand or pneumatic tool whose point or edge is rounded sufficiently to avoid damage to weld metal.

Electroslag welding is prohibited. However, electrogas requirements under AWS D1.1, Appendix C, apply.

When evidence of record is accepted in lieu of required tests for electrogas weld metal properties, the Contractor shall furnish the manufacturer's certification that the filler metal and shielding being used on the project were manufactured with the same material and process requirements as the filler and shielding used for the evidence of record procedure.

(E) WELDING INSPECTION. The Contractor shall furnish proper equipment and qualified personnel to make radiographic, ultrasonic, magnetic particle and other tests of shop and field welds.

Personnel performing non-destructive tests shall be qualified per the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A. Only persons qualified for NDT LEVEL I and supervised by a person qualified for NDT LEVEL II, or persons qualified for NDT LEVELS II or III may perform nondestructive tests. Prequalification certification shall be furnished on request.

Radiographs, ultrasonic and magnetic particle tests shall be made only in the presence of the Inspector. Test results shall be approved before members will be accepted.

Inspection of welds in all steel shall begin after the welds have reached ambient temperature, except welds in A514/A517 steels which shall be inspected not less than 48 hours after they are completed. However, at junctions of intersecting welds subject to nondestructive tests, inspection and test shall be conducted after welded junction is complete.

In addition to inspection per AASHTO and criteria listed below under Radiographic and Magnetic Particle Tests, all welds shall be visually inspected for cracks. Procedures, techniques and standards of acceptance shall be per AASHTO.

All radiographs, ultrasonic test reports, and magnetic particle test reports, including those of defective welds, shall become District property.

(1) RADIOGRAPHY AND ULTRASONIC TESTS. The following groove welds forming butt, tee, or corner joints on girders, beams, stringers, brackets, truss members or the members shall be examined in accordance with AASHTO by the radiographic or ultrasonic method as determined by the Engineer. The weld thickness shall be a minimum of 1/2 inch for ultrasonic testing.

(a) 100 percent of all shop welded flanges and flange splices plus 25 percent of all shop welded web splices adjacent to the top flange and 25 percent adjacent to the bottom flange.

(b) 100 percent of all shop splice welds when more than 10 percent of radiographs or ultrasonic tests

indicate rejectable defects until accumulated rejection level falls to 10 percent or less, then the original percent level specified above shall again govern.

(c) 100 percent of all field welded flange splices except box girder longitudinal flange seam splices.

(d) 100 percent of all field welded web splices.

(2) MAGNETIC PARTICLE TESTS. The following shop and field fillet welds shall be examined by the magnetic particle method per ASTM E 109.

(a) At least 1 foot of every 10 feet of weld and 1 foot of each weld less than 10 feet of each size weld. Test shall be located at random so as to be typical for each size weld.

(b) The full length of the weld, or 5 feet on one side of the test length, whichever is less, when test indicates a rejectable defect in any test length of weld.

(c) Areas on each side of a rejectable defect to determine extent of defect.

(d) 100 percent of repaired welds for welds found defective by magnetic particle tests.

(3) DYE PENETRANT TESTS. In field welded girder and beam groove weld splices without the aid of backing, the joint shall be chipped, gouged or ground to sound metal on the root side after sufficient welding has been done on one side, and the root areas then examined by the dye penetrant method per ASTM E 165. Edges of flange butt welds shall be examined by the dye penetrant method. The dye penetrant method may be substituted for magnetic particle testing for shop welds only.

706.19 SHEAR DEVICES

Studs for shear devices shall conform to the requirements for the respective materials as provided in 815.01(F). They shall be attached to the beams as shown on the plans. Welding shall conform to the requirements outlined herein. Special patented devices, and connections therefore, if specified, shall be constructed according to the manufacturer's recommended practice or as shown on the plans.

All structural steel in a particular span of a bridge must be erected and have deck forming complete in place before shear devices are attached in that span.

Stud welding shall conform to the requirements of AASHTO and the following:

1. Before any stud welding operation is begun, or after the welding equipment has remained idle for 1 hour, trial studs shall be welded to a structural steel plate for testing. After being welded to the plate and the weld has cooled, each stud will be bent down to the plate by striking with a hammer. This test will be continued until there is no failure of trial stud.

2. Longitudinal and lateral spacings of stud shear connectors with respect to each other and to edges of beam or girder flanges may vary a maximum of 1 inch from the location shown on the drawings, provided the adjacent studs are not closer than 2-1/2 inches center to center. The minimum distance from the edge of a stud base to the edge of a flange shall be the diameter of the stud plus 1/8 inch, but preferably not less than 1-1/2 inch. The accuracy of location of other types of studs shall be such as to permit a workmanlike assembly of attachments without alterations or reaming.

3. After stud welding is completed, a visual inspection of the studs and welding will be made by the Engineer for approval prior to placing of the concrete slab.

4. If during the progress of the work, testing and inspection indicate, in the sole judgment of the Engineer, that the type of studs, equipment, etc., being furnished are not in accordance with AWS requirements, the Contractor will be required to change equipment and/or change to another type of stud or shear developer at no additional cost to the District.

706.20 PAINTING

Structural steel shall be shop painted in conformance with the requirements of 707.

706.21 MARKING AND SHIPPING

Each member shall be painted or marked with an erection mark for identification and erection diagrams shall be furnished with erection marks thereon, as outlined in 105.02.

The Contractor shall furnish the Engineer with 2 copies of shipping statements. The weights of the individual members shall be shown on the statements. Members weighing more than 5 tons shall have the weight marked thereon. Bolts of one length and diameter and loose nuts or washers of each size shall be packed separately. Pins, small parts and packages of bolts, washers, and nuts shall be shipped in boxes, crates kegs, or barrels, but the gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each package.

The loading, transportation, unloading, and field storage of fabricated and rolled material shall be conducted so as to avoid injury and deformation of the metal.

Damaged material shall be repaired or replaced by the Contractor at his sole expense.

The Contractor shall make the necessary arrangements for the transportation, unloading and hauling of the steel to the point of placement.

Material to be stored shall be placed on skids above the ground. Storage should be under shelter if possible but in any event members shall be placed where least likely to be marred or subject to contamination of any sort. Members shall be stored so as to avoid formation of water-holding pockets and kept properly drained. If storage is outdoors for several months, the shop coat shall be inspected periodically for integrity and any chalking surfaces cleaned and repainted with a shop coat. Girders and beams shall be placed upright and shored. Long members shall be supported on skids placed near enough together to prevent injury from deflection.

The Contractor shall be responsible for the loss and/or damage of any material delivered and/or stored for the work under contract.

706.22 BEARINGS AND ANCHORAGE

Masonry bearing plates, shoes and pedestals shall not be placed upon bridge seat bearing areas which are improperly finished, deformed or irregular.

Bridge bearings shall be set level, in exact position and shall have full and even bearing on the masonry.

Care shall be taken that full, free movement of the superstructure at the movable bearings is not restricted by improper setting or adjustment of bearings or anchor bolts and nuts.

Unless otherwise specified on the plans, or directed by the Engineer, bearing plates, shoes and pedestals shall be set by one of the methods outlined in 703.20.

Lead shall meet the requirements of 815.11.

706.23 ERECTION

(A) METHODS AND EQUIPMENT. Before start of erection, the Contractor shall submit for approval all necessary erection diagrams, the amount and type of erection equipment he proposes and other details as requested.

The approval of the Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the plans and specifications. No work shall be done until such approval by the Engineer has been obtained.

(B) FALSEWORK. All work for falsework design, submittals of design calculations and working and erection drawings for falsework and construction and maintenance of falsework shall be performed in accordance with the requirements of 703.16. These requirements also apply when it is necessary to make changes to an existing structure for maintaining traffic. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

(C) ASSEMBLING STEEL. The parts shall be accurately assembled as shown on the plans and any match marks shall be followed. The material shall be carefully handled so that no parts will be bent, broken, or otherwise damaged. Hammering which will injure or distort the members will not be permitted. Bearing surfaces and surfaces to be in permanent contact shall be cleaned before the members are assembled.

Before start of field bolting or welding, the structure shall be adjusted to correct grade and alignment and the elevations of panel points and other points as needed adjusted. Rebolting and rewelding due to incomplete and incorrect structure adjustments beforehand shall be at Contractor expense.

After hoisting steel members into position and prior to releasing weight to the member or releasing hoisting devices, each field bolted connection shall have 25 percent of the holes filled with erection bolts and 25 percent with cylindrical erection pins before high strength bolting. Each field bolted connection carrying superimposed loads during erection shall have 38 percent of the holes filled with bolts and 38 percent with pins before high strength bolting.

Fitting-up bolts shall be the same diameter as high strength bolts, and cylindrical erection pins shall be 1/32 inch larger.

(D) MISFITS. The correction of minor misfits involving non-harmful amounts or reaming, cutting, and chipping will be considered a legitimate part of the erection.

However, any error in the shop fabrication or deformation resulting from handling and transportation which prevents the proper assembling and fitting up of parts by the moderate use of drift pins or by a moderate amount of reaming and slight chipping or cutting, shall be reported immediately to the Engineer and his approval of the method of correction obtained. The Contractor shall be responsible for all misfits, errors, and

injuries, and shall make the necessary corrections and/or replacements

(E) REMOVAL OF FALSEWORK AND CLEANUP. Upon completion of the erection and before final acceptance the Contractor shall remove all falsework, excavated or useless materials, rubbish and temporary buildings, replace or renew any fences damaged and restore in an acceptable manner all property, both public and private, which may have been damaged during the prosecution of this work, and shall leave the bridge site and adjacent highway or street in a neat and presentable condition satisfactory to the Engineer. All excavated material or falsework placed in the stream channel during construction shall be removed by the Contractor as soon as practicable.

706.24 MEASURE

Structural Steel will be measured by one of the methods as specified herein. The Pay Item Schedule will indicate which method is applicable.

(A) The unit of measure for Structural Steel will be the job. No actual measurement will be made.

(B) The unit of measure for the various items of Structural Steel as listed in the Schedule of Prices will be the pound. The number of pounds will be the actual number of pounds of Structural Steel complete in place as computed from approved shop drawings.

The weights of plates shall be computed on the basis of 0.2833 pounds per cubic inch of steel. No allowance will be made for overrun.

Weights shall be computed on the basis of the net finished dimensions of parts as shown on approved shop drawings, deducting for copes, cuts, clips, and all open holes, except bolt holes.

The weight of castings will be computed from the dimensions shown on approved shop drawings, deducting for holes. To this weight will be added 5 percent allowance for fillets and overrun.

The following unit weights in pounds per cubic foot shall apply:

Aluminum, cast or wrought			173.0
Bronze, cast		536.0	
Copper-alloy		536.0	
Copper sheet		558.0	
Iron, cast			445.0
Iron, mallable			470.0
Lead, sheet		707.0	
Steel, cast, copper bearing, silicon, nickel and stainless	490.0		
Zinc			450.0

Certified scale weights may be substituted for computed weights if approved by the Engineer. In computing on the basis of certified scale weights, fabricated members shall be weighed on approved scales in the presence of the Inspector. If shop paint has been applied to the completed member when weighed, 0.004 of the member's weight shall be deducted from the scale weights to compensate for weight of shop paint.

The weight of field and shop bolts heads, nuts, washers and shank length in excess of grip will be included as follows:

Diameter of Bolt (inches)	Bolts-weight per hundred (pounds)
1/2	19.7
5/8	31.7
3/4	52.4
7/8	80.4
1	116.7
1-1/8	165.1
1-1/4	212.0

The weight of temporary erection bolts, shop and field paint, boxes, crates, and other containers used for shipping, and materials used for supporting members during transportation and erection, shall not be included. No measurement will be made for the weight of weld metal.

The Contractor shall compute the weights of all structural steel from his approved shop drawings and shall submit this information to the Engineer in suitable form for verification. Weights shall be suitably classified, conforming to various items of structural steel listed in the Schedule of Prices.

For each member, there shall be given a complete shop bill, listing all plates, shapes, and other parts, with the weights thereof, a notation of the amount deducted for clips and other cutoff parts, and the net remaining weight. The tabulations shall include summaries identifying and combining the weights of all individual members, and a general recapitulation giving the total weight under each division and the total pay quantity. Three copies of these data shall be supplied to the Engineer.

706.25 PAYMENT

This work will be paid for as Structural Steel as measured in 706.24(A) and 706.24(B), and the Pay Item Schedule will indicate which method is applicable.

(A) Payment for Structure Steel will be at the contract lump sum price, which payment will include all materials, labor, equipment, tools, and incidentals necessary to complete the specified work.

(B) Payment for Structural Steel will be at the contract unit price per pound, which payment will include all materials, labor, equipment, tools, and incidentals necessary to complete the specified work.